MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

PCF0145 – CELL AND FUNCTION

(Foundation in Life Sciences)

18 OCTOBER 2016
2.30 p.m - 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **10** printed pages excluding the cover page with **5** structured questions.
2. Answer **ALL** questions.
3. Distribution of marks for each section/question is given.

STRUCTURED QUESTIONS [100 MARKS]

Instructions: Answer **ALL** questions. Write your answers in the Answer Booklet.

Question 1 [20 marks]

a. Of the three types of selection, which selection best describes each of the following examples:
   i. Some individuals are very fast runners and some are very slow. Overall, most individuals are close to average. (1 mark)
   ii. The peppered moth may be a light color or a dark color, with very few individuals being a color in between two extremes. (1 mark)
   iii. A rise in environmental temperature over time leads to an increase in the length of ears in foxes. (1 mark)
   iv. Farmers have selected cattle to produce some breeds with horns and some without. (1 mark)

b. Explain the concept of competitive exclusion principle by using *Paramecium caudatum* and *Paramecium aurelia* as an example. (6 marks)

c. Write the main function for these carbohydrates below:
   i. Cellulose (1 mark)
   ii. Starch (1 mark)
   iii. Glycogen (1 mark)

d. **Figure 1** shows the mechanism of enzyme reaction.
   i. Define enzyme. (1 mark)
   ii. Which structure will be denatured if the temperature is increased? (1 mark)
   iii. State two types of enzyme inhibitors. (2 marks)
   iv. Write three characteristics of enzyme. (3 marks)

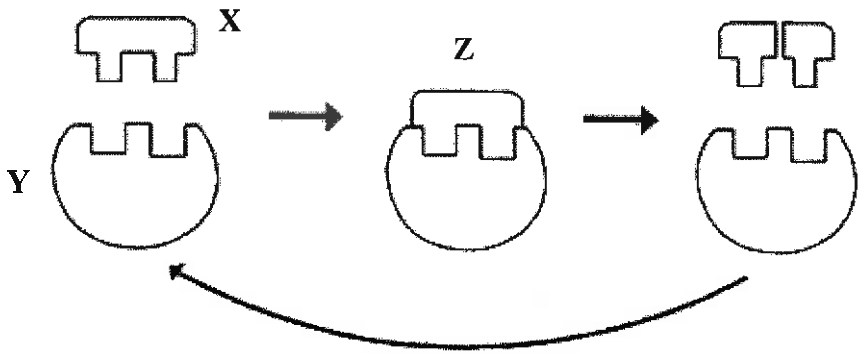

Figure 1

Continued.....

Question 2 [20 marks]

a. Red blood cells are put in sodium chloride solutions with different concentrations labeled R, S, T, U, V and W. The results are shown in **Table 1**.

i. Based on **Table 1**, state the concentration of sodium chloride in the blood plasma. Give your reason. (2 marks)

ii. What will happen to the red blood cell if it is placed in distilled water? Briefly explain. (3 marks)

Solution	Concentration of sodium chloride ($g/100cm^3$)	Percentage of cells	
		Crenated	Hemolyzed
R	0.35	0	52
S	0.40	0	28
T	0.47	0	0
U	0.50	9	0
V	0.55	35	0
W	0.60	86	0

Table 1

b. **Figure 2** shows an animal cell with its organelles.

i. State the function of the nucleus. (1 mark)

ii. Organelles are bounded by membranes. Give two significances of this observation. (2 marks)

iii. Explain what will happen to the production of protein if organelle **Q** and organelle **R** are absent. (2 marks)

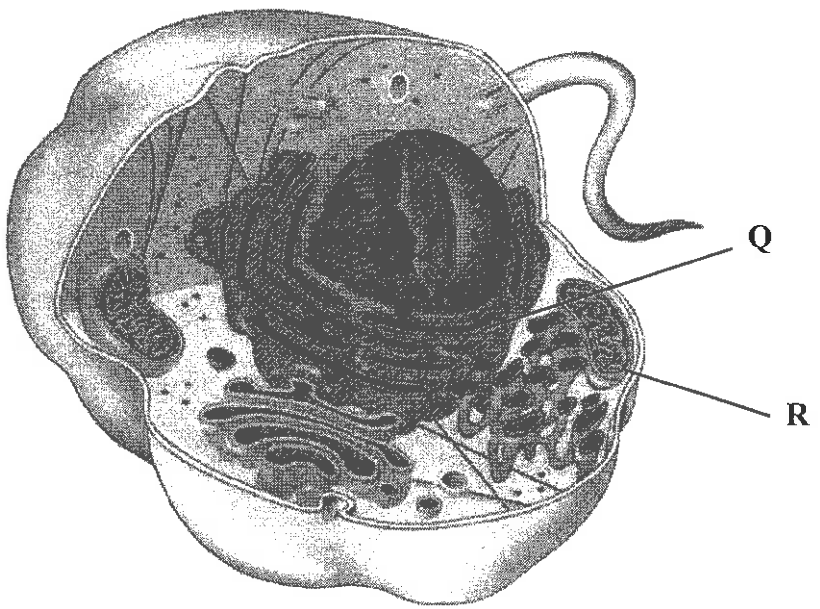

Figure 2

Continued.....

c. A summary of cellular respiration process is shown in **Figure 3**.

i. Briefly explain the process of making ATP in **stage 3**. (5 marks)

ii. How many ATP will be formed in **stage 1** and **stage 2**? (1 mark)

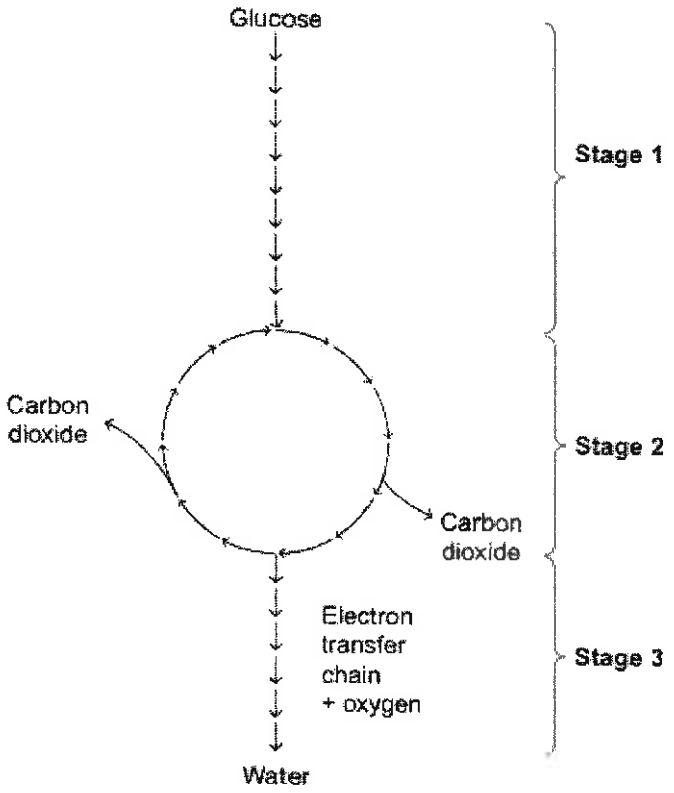

Figure 3

d. Explain the lactic acid fermentation process that happens in human muscle cells. (4 marks)

Continued.....

Question 3 [20 marks]

a. A researcher found a unique plant that is able to make more chlorophyll *b* than ordinary plants. He investigated the effect of having more chlorophyll *b* on the rate of photosynthesis. He grew the unique plant and ordinary plant in low light intensity and high light intensity. He measured the oxygen production by the chloroplasts of these two types of plants. **Figure 4** shows the results of his observations.

i. Explain why the researcher measured the rate of production of oxygen in this investigation. (2 marks)

ii. The researcher suggested that the unique plant would grow faster than the ordinary plant in all light intensities. Explain how these data support the suggestion. (3 marks)

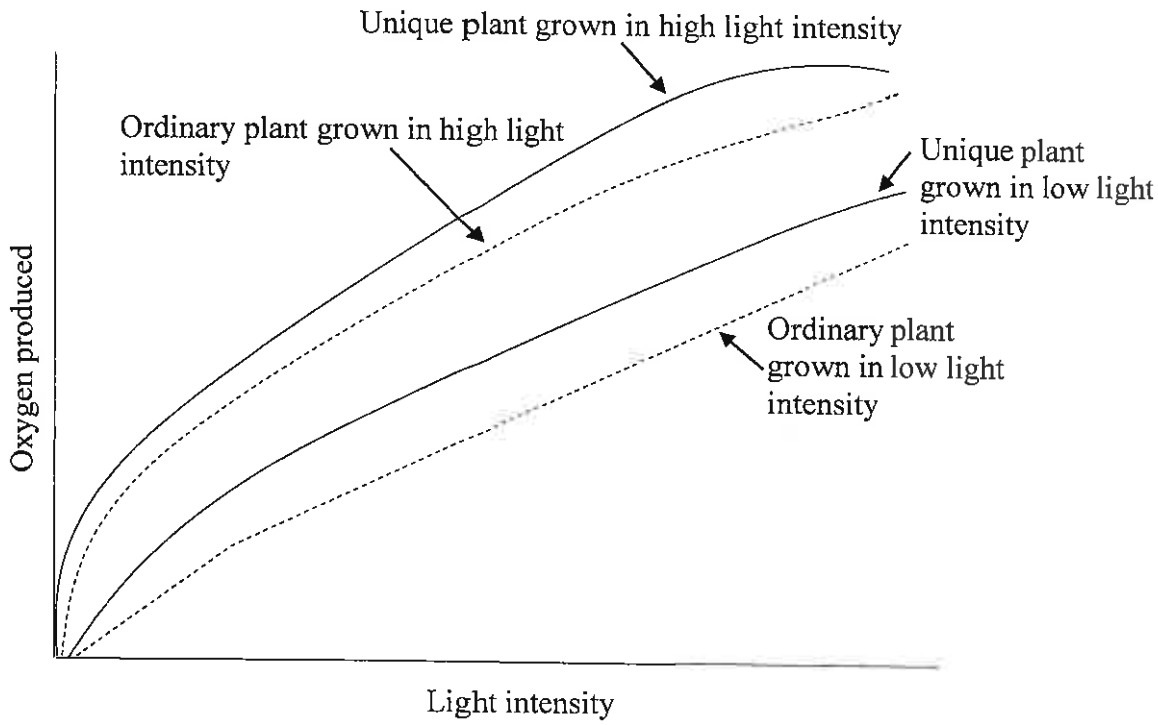
Unique plant grown in high light intensity
Ordinary plant grown in high light intensity
Unique plant grown in low light intensity
Ordinary plant grown in low light intensity
Oxygen produced
Light intensity

Figure 4

b. **Figure 5** shows the main stages of the Calvin cycle.

i. State precisely where the Calvin cycle occurs in plant cells. (1 mark)

ii. Briefly describe how carbon dioxide is fixed in the Calvin cycle. (2 marks)

iii. What will happen to the concentration of RuBP and G3P if the supply of carbon dioxide is reduced? (2 marks)

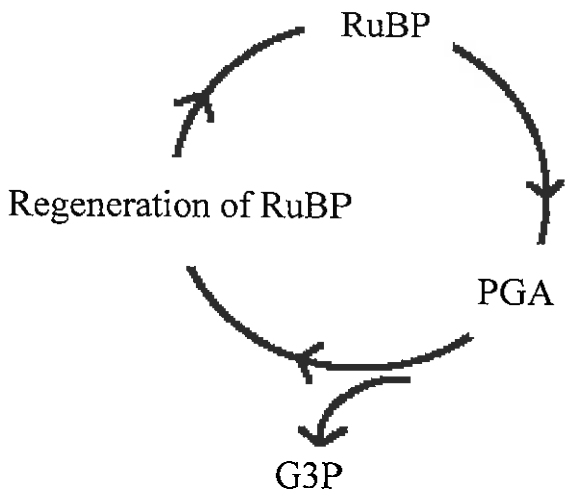

Figure 5

c. **Figure 6** shows a stage in the breathing process.

i. State the stage of the breathing shown. (1 mark)

ii. Explain the function of **X** in the stage of breathing mentioned in c(i). (2 marks)

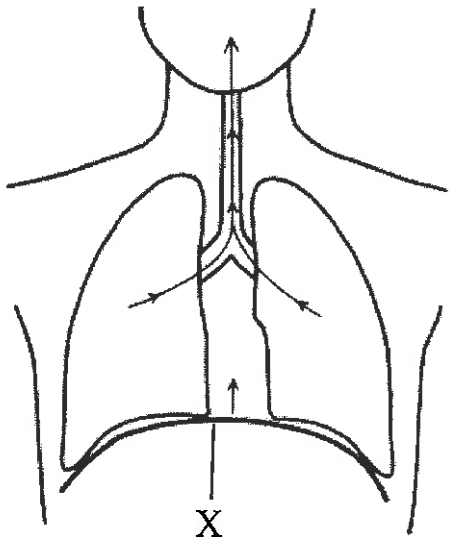

Figure 6

Continued.....

d. **Figure 7** shows the reactions that occur in the transport of carbon dioxide by the red blood cell when it arrives in the lungs.

i. Name the substances labeled **A**, **B**, **C** and **D**. (4 marks)

ii. What is the meaning of chloride shift? (2 marks)

iii. State another way in which carbon dioxide is carried in the blood. (1 mark)

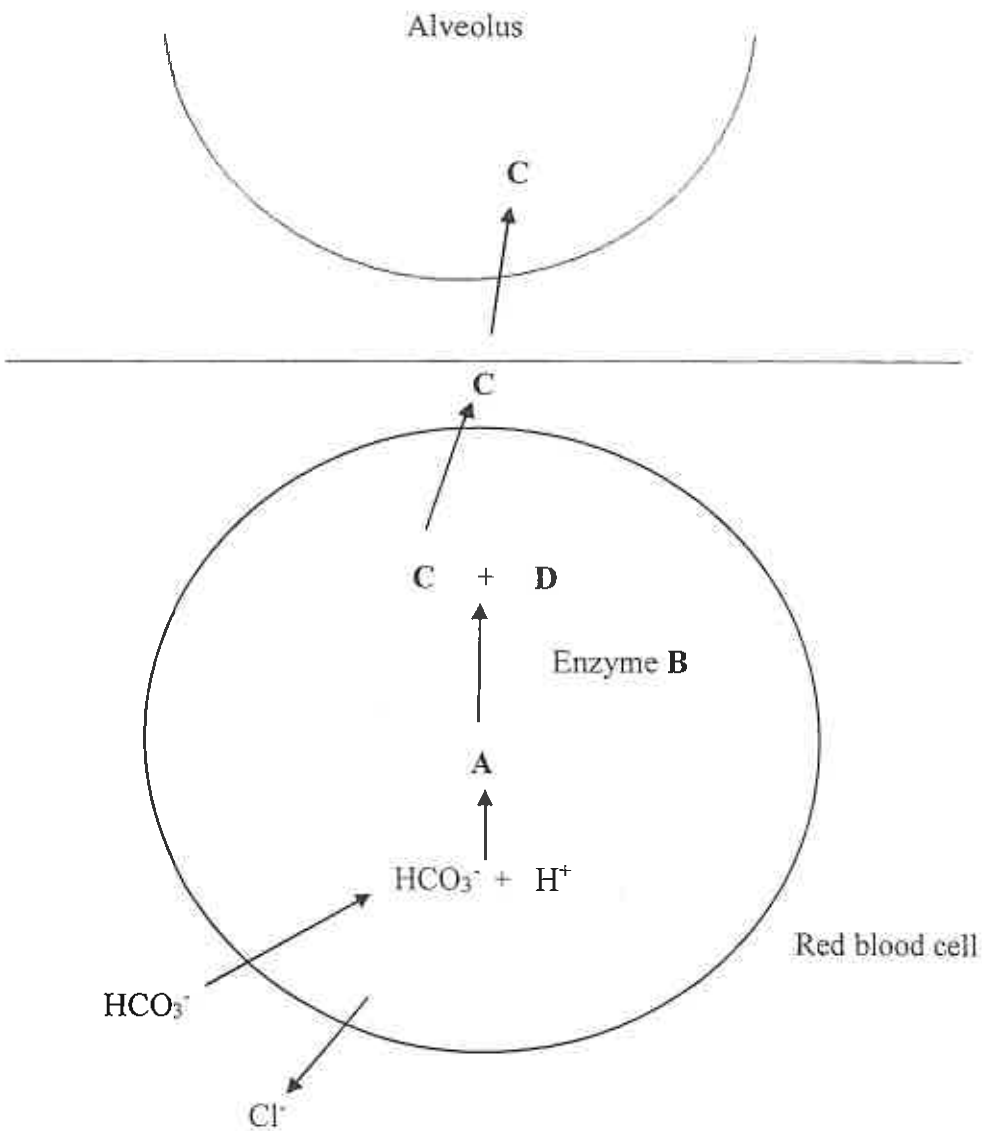

Figure 7

Continued.....

Question 4 [20 marks]

a. **Figure 8** shows a vertical section through a human heart.

i. Briefly explain how structures labeled **X** and **Y** initiate the heartbeat. (2 marks)

ii. What is an artificial pacemaker? (1 mark)

iii. ECG produces waves that are known as P, QRS and T waves. State what happened during:

- P wave
- QRS wave
- T wave

(3 marks)

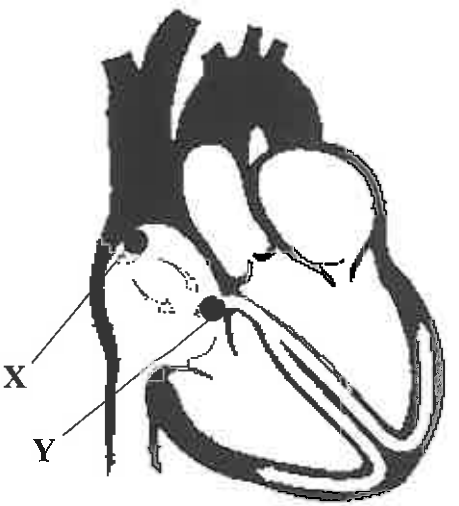

Figure 8

b. The following flow chart below shows the pathway of blood through the heart.

i. Name structures **P** and **Q**. (2 marks)

ii. Briefly describe how the valves **A** and **B** ensure the one-way flow of blood through the heart. (3 marks)

Vena cava → right atrium → valve **A** → structure **P** → valve D → pulmonary artery → lungs → structure **Q** → left atrium → valve **B** → left ventricle → valve C → aorta

Continued.....

c. **Figure 9** shows the homeostatic control of human body temperature.

i. Define homeostasis. (1 mark)

ii. Name the corrective mechanism **X**. (1 mark)

iii. State four corrective mechanisms that can be done by the human body to decrease the body temperature. (4 marks)

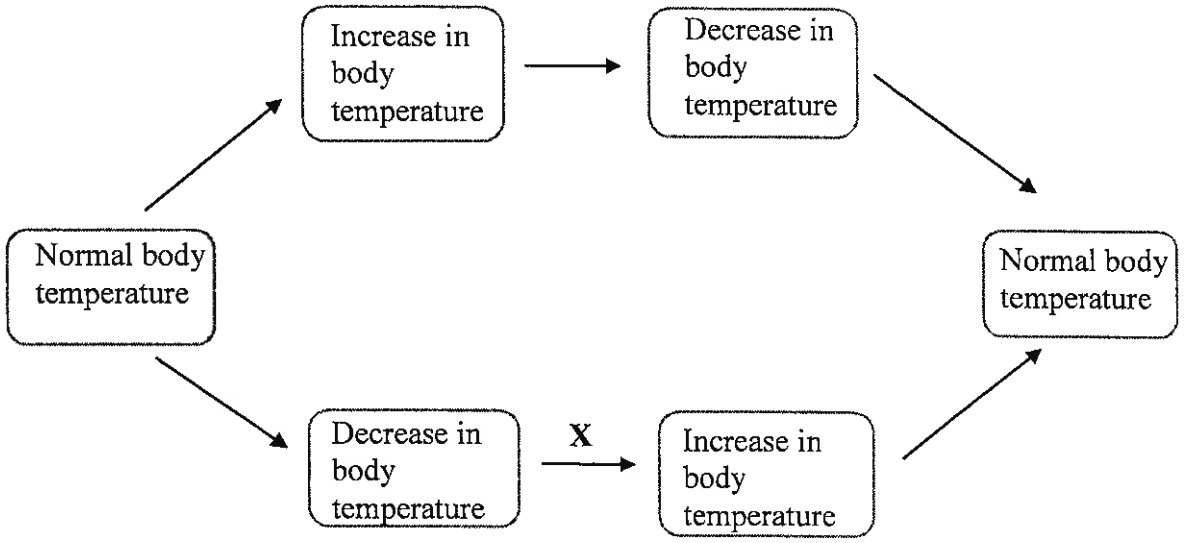

Figure 9

d. **Figure 10** shows the Bowman's capsule and glomerulus of a nephron.

i. Name the process that takes place in the Bowman's capsule. (1 mark)

ii. Give one feature of the blood vessels associated with the glomerulus and explain how this feature facilitates the process that takes place in d(i). (2 marks)

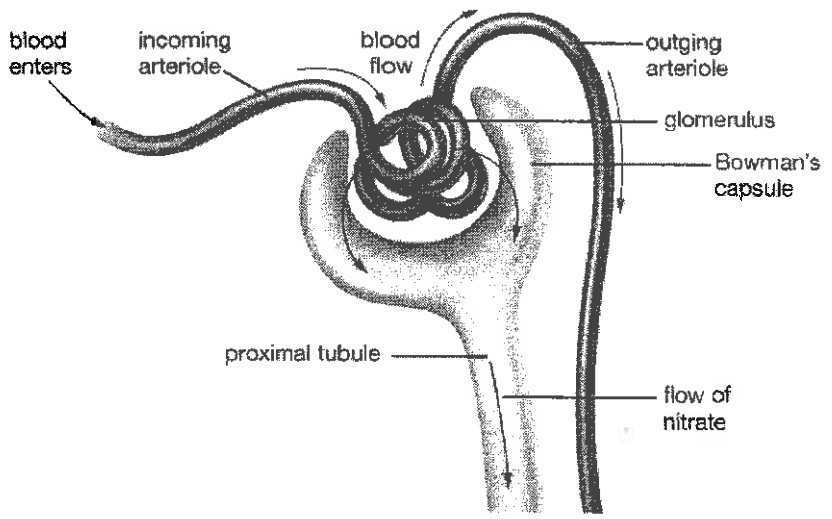

Figure 10

Continued.....

Question 5 [20 marks]

a. **Figure 11** shows the transmission of information process involving the three types of neurons. Explain the transmission of a nerve impulse from the organ to the muscle using these three types of neurons. (7 marks)

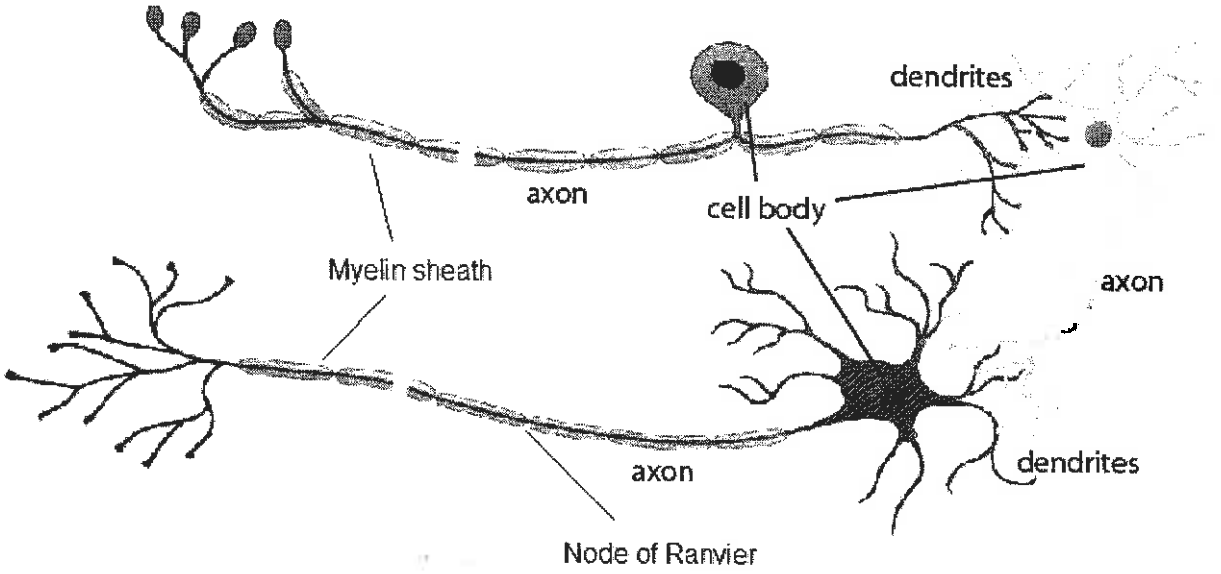

Figure 11

b. Briefly explain two factors that can affect the rate of transmission of an impulse along an axon. (4 marks)

Continued.....

c. Auxin is one of the most important hormones in plants.
   i. Explain the 'apical dominance' phenomenon caused by auxin. (1 mark)
   ii. What is 'nipping'? (1 mark)
   iii. What is the effect of 'nipping'? (1 mark)

d. Complete **Table 2** below by writing the name of a hormone involved in the function described and the name of the gland which produced it. (6 marks)

Gland	Hormone	Function
i.	ii.	Promotes retention of water by kidneys
iii.	iv.	Lowers blood calcium level
v.	vi.	Promote development and maintenance of male secondary sex characteristics

Table 2

End of Page